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(54) **LIGHT-WEIGHT ELECTRIC MOTOR DRIVEN FLUID PUMP ASSEMBLY**

(75) Inventors: **Ann M. Casper**, Roxbury, CT (US); **John F. O'Connor, Jr.**, New Hartford, CT (US); **John F. O'Connor, Sr.**, deceased, late of Torrington, CT (US), by Maureen O'Connor, executrix

(73) Assignee: **Torrington Research Company**, Torrington, CT (US)

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(51) **Int. Cl.**[7] **F04B 17/00**; F04B 35/04

(52) **U.S. Cl.** **417/423.14**; 417/420; 417/423.7

(58) **Field of Search** 417/423.5, 423.8, 417/423.14, 420, 421, 366–371, 352, 353, 355, 351, 423.7

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,630,645	A	*	12/1971	Eheim	417/420
4,234,293	A	*	11/1980	Lightle	417/365
4,806,080	A	*	2/1989	Mizobchi et al.	417/353
5,009,578	A	*	4/1991	Hyland	417/365
5,055,006	A	*	10/1991	Kobayashi et al.	417/366
5,388,970	A	*	2/1995	Muckelmann et al.	417/363
5,823,753	A	*	10/1998	Kemmerling	417/423.14
5,895,207	A	*	4/1999	Burgdorf et al.	417/410.1
5,915,931	A	*	6/1999	Lindner et al.	417/420
6,095,771	A	*	8/2000	Schelhas et al.	417/423.14
6,274,962	B1	*	8/2001	Kliman	310/261

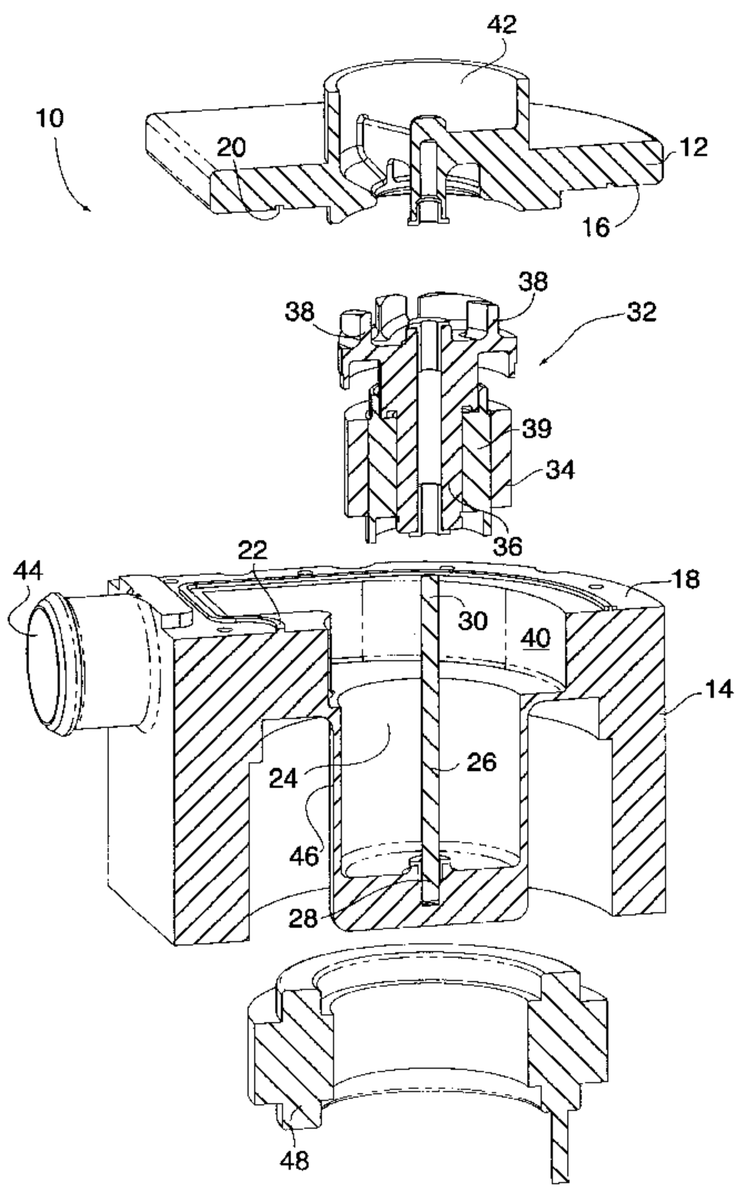
* cited by examiner

Primary Examiner—Charles G. Freay
Assistant Examiner—Han L Liu
(74) *Attorney, Agent, or Firm*—Theodore R. Paulding

(57) **ABSTRACT**

A light-weight electric motor driven fluid pump assembly having a molded thermoplastic housing of two parts which form a fluid impervious rotor chamber, a stationary shaft journalled in the housing parts within the chamber and carrying a magnetic rotor and a fluid impeller driven thereby. The housing parts also define inlet and discharge ports in communication with the rotor chamber adjacent the impeller blades. One portion of the housing of one housing part defines a cylindrical thin walled tubular configuration with a cylindrical exterior surface for mounting a stator thereabout. The housing parts are welded together at mating surfaces with the result that neither static nor dynamic seals are required in the assembly.

6 Claims, 4 Drawing Sheets



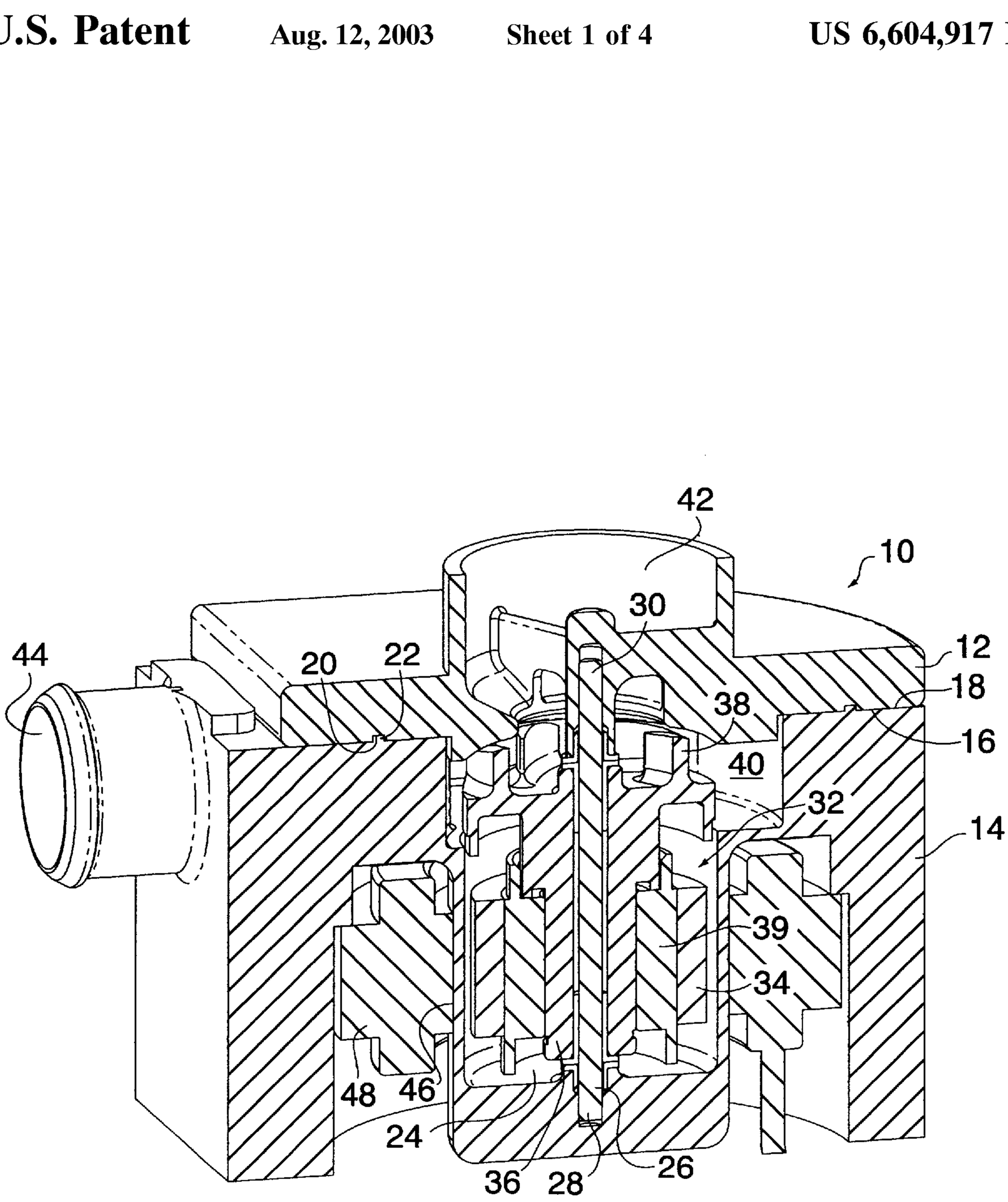


FIG. 1

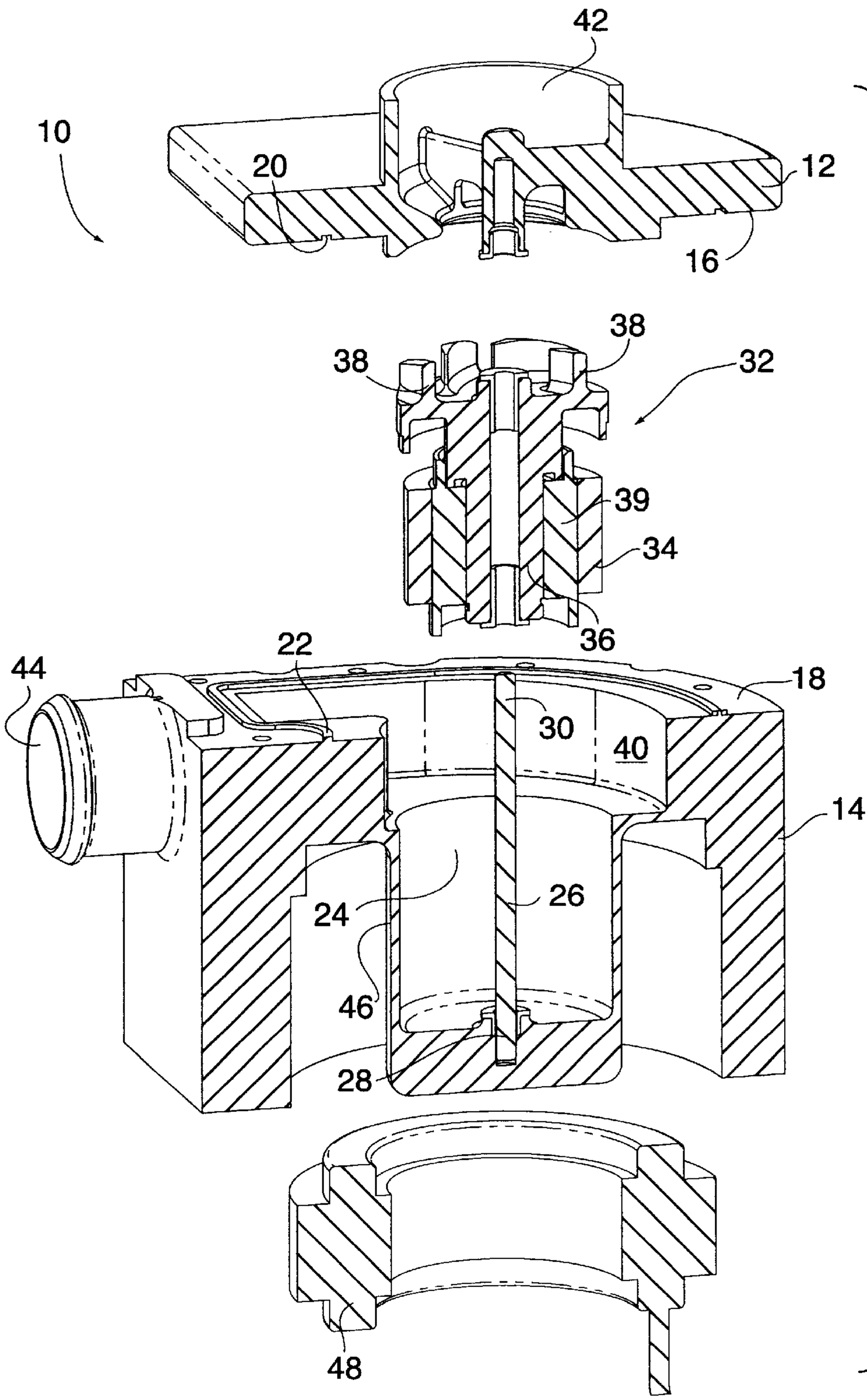


FIG. 2

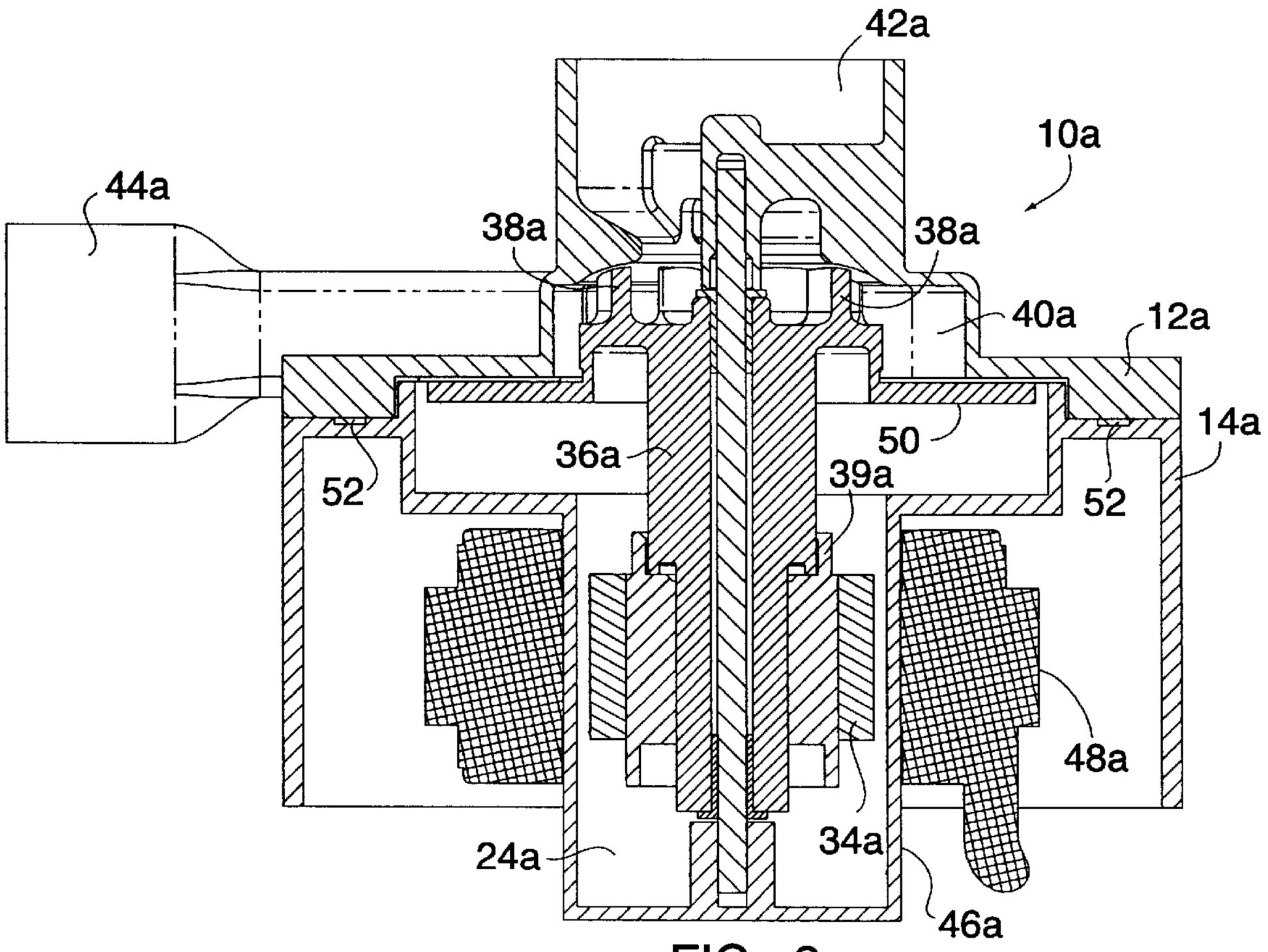


FIG. 3

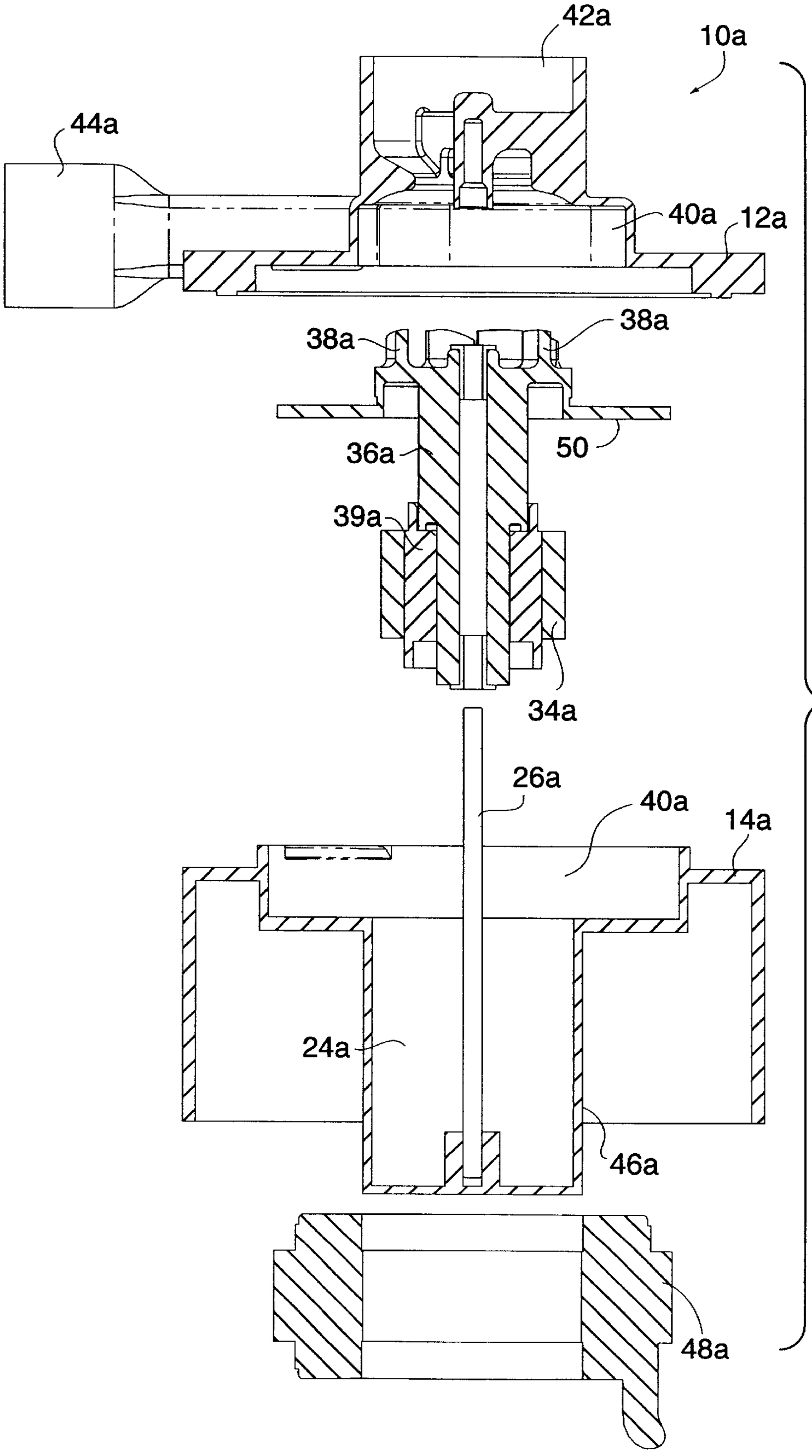

42a
10a
44a
40a
12a
38a
38a
36a
50
39a
34a
26a
40a
14a
24a
46a
48a

FIG. 4

LIGHT-WEIGHT ELECTRIC MOTOR DRIVEN FLUID PUMP ASSEMBLY

This application claims the benefit of provisional application Ser. No. 60/238,143 filed on Oct. 6, 2000.

FIELD OF THE INVENTION

The present invention relates to a small light-weight electric motor driven fluid pump of the type having an integrated motor and pump construction resulting in a simplified design and a minimum of static and/or dynamic seals.

BACKGROUND OF THE INVENTION

Integrated electric motor-fluid pump assemblies have hereto been available but have generally exhibited an undesired complexity with a number of housing parts, protruding rotor shafts, and both static and dynamic sealing requirements.

It is the general object of the present invention to provide a small light-weight electric motor driven fluid pump assembly having a molded thermoplastic housing of no more than two mating parts which form a fluid impervious rotor chamber and which journal a stationary shaft carrying a magnetic rotor and a fluid impeller driven thereby, said housing requiring neither static nor dynamic seals and exhibiting a highly efficient integrated motor-pump design.

SUMMARY OF THE INVENTION

In fulfillment of the foregoing object and in accordance with the present invention, a light-weight electric motor driven fluid pump assembly is provided with a molded thermoplastic housing of no more than two parts which form a fluid impervious rotor chamber when assembled. A shaft is journalled within the housing at opposite ends respectively by said two housing parts and carries a rotor assembly comprising a magnetic rotor forming a first part of an electric motor and a fluid impeller driven thereby. The housing parts also define fluid and inlet discharge ports in communication with the rotor chamber adjacent the impeller and one of the housing parts which defines a portion of the rotor chamber has a relatively thin walled tubular ID) configuration with a cylindrical exterior surface in coaxial relationship with the magnetic rotor in the rotor chamber. An annular stator forming a second motor part is disposed on or about said exterior surface for magnetic co-operation with the rotor. Thus, the motor and pump are effectively integrated and there is no penetration of the housing other than the magnetic cooperation between the rotor mounted within the housing and the stator mounted externally thereof.

The two parts of the housing are joined in assembled relationship at mating surfaces and may be provided with a single continuous static seal between said surfaces, this of course constituting the most reliable of sealing arrangements. Preferably, however, there is no seal whatsoever between the two housing parts and, instead, the parts are joined in assembled relationship by a continuous weld, thus dispensing with the need for even a simple static seal. In order to facilitate effective fluid tight welding, one of the housing parts may be provided with a small continuous raised bead on its mating surface and the other of the parts may have a small continuous groove which receives and complements the bead. Finally, various welding techniques may be employed but in the presently preferred construction the two housing parts are secured in assembled relationship employing a sonic welding technique.

DRAWINGS

FIG. **1** is a perspective view in section of an improved motor-pump assembly constructed in accordance with the present invention.

FIG. **2** is an exploded perspective view of the motor-pump assembly of FIG. **1**.

FIG. **3** is a side view in section of a second embodiment of a motor-pump assembly of the present invention.

FIG. **4** is an exploded view of the motor-pump assembly of FIG. **3**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring particularly to FIGS. **1** and **2**, a motor pump assembly in accordance with the present invention is indicated generally at **10** and comprises first and second housing parts **12** and **14** shown in FIG. **1** in assembled relationship and in FIG. **2** in an exploded view prior to assembly. The parts have mating flat surfaces **16** and **18** with the surface **16** having a continuous groove **20** and the surface **18** a continuous bead **22**. The groove **20** and bead **22** are complementary to facilitate welding with the parts in assembled relationship as shown in FIG. **1**. Various welding techniques may be employed but sonic welding is preferred and results in a fluid tight joint thus dispensing with the need for even a static seal between the parts **12** and **14**.

With the housing parts **12** and **14** in assembled relationship, they cooperatively define a fluid impervious rotor chamber **24**. Stationary shaft **26** is journalled at a lower end portion **28** in the housing part **14** and at an upper end portion **30** in the upper housing part **12**. Rotor assembly indicated generally at **32** is carried by the shaft **26** and comprises an annular magnetic rotor **34** which forms a first part of an electric motor and a fluid impeller **36** driven by the rotor **34**. An annular rotor support member **38** is also interposed between the rotor **34** and the impeller **36** with impeller blades **38** provided at an upper end portion of the impeller. An impeller chamber **40** defined in an upper end portion of the housing part **14** communicates with an axial inlet port **42** and a radial discharge port **44**, with the chamber **40** taking the configuration of a conventional scroll between its central portion and the discharge port **44**.

The lower housing part **14** also has a depending thin walled portion **46** disposed about the rotor **34** and which has a smooth exterior surface for mounting an annular stator **48** forming a second part of the electric motor which drives the pump impeller **36**. The stator **48** may be mounted on and about the cylindrical portion **46** by means of press fitting, adhesive bonding etc.

As will be apparent, a magnetic interaction between the rotor **34** and stator **48** will result in the desired rotation of the rotor, and the pump impeller including the blades **38**. Fluid entering the assembly at the inlet **42** will be largely contained within the impeller chamber **40** but may also enter the chamber **24** there beneath so that the rotor **34**, support **38**, and the lower portion of the impeller will be immersed in fluid. The stator **48**, on the other hand, is in a dry exterior location but nevertheless fully co-operative with the rotor **34**. No seals of either the static or dynamic type are required.

FIGS. **3** and **4** illustrate a motor-pump assembly **10***a* substantially identical with the motor assembly **10** of FIGS. **1** and **2** except for the provision of a flange **50** on the impeller. The flange **50** forms one side (the floor as shown) of an impeller or scroll housing **40***a* with the operation of the assembly remaining the same as in FIGS. **1** and **2**. Fluid is

largely contained in the housing **40***a* but limited flow from the scroll-impeller housing **40***a* downwardly about the flange **50** into the rotor chamber **24***a* results in immersion of the rotor **34***a*, the impeller **36***a*, and the rotor support **39***a* in the fluid being pumped by the impeller blades **38***a* . Thus, the parts within the housing portion **46***a* are immersed in fluid being pumped as in FIGS. **1** and **2** above whereas stator **48***a* is in a dry environment and yet co-operates fully with the rotor **34**.

Contrary to the location of the impeller housing in the embodiment of FIGS. **1** and **2**, in **3** and **4** the housing is defined within the upper housing part **12***a* and communicates internally with the discharge opening **44***a* . In assembling the housing parts **12***a* and **14***a* a weld is provided at **52** and may be of the sonic type as above. With a fluid tight weld at **52** there is no need for seals of either the static or dynamic type as in FIGS. **1** and **2**.

As will be apparent from the foregoing, the integrated motor-pump assembly of the present invention is of a desirably simple construction comprising only two housing parts, a rotor assembly and a stator. The assembly operation can be completed in a most efficient manner and when the parts have been welded together at their mating surfaces a fluid impervious chamber is provided with no seals of any kind. The molded thermoplastic of the preferred light-weight construction of housing parts results in over-all light-weight construction of the assembly and together with the simplified design of the assembly results in highly efficient operation and a long service life.

What is claimed is:

1. A light-weight electric motor driven fluid pump assembly having a thermoplastic housing of no more than two parts moldable in a conventional molding process employing straight and/or side pulls and which form a fluid impervious rotor chamber when assembled, a shaft wholly within said chamber carrying a rotor assembly wholly within said chamber and comprising a magnetic rotor forming a first part of an electric motor and a fluid impeller driven thereby thus eliminating requirement for a dynamic seal, said housing parts also defining fluid inlet and discharge ports in communication with said rotor chamber adjacent said impeller, and one of said housing parts defining a portion of said rotor chamber having a relatively thin-walled tubular configuration with a cylindrical exterior surface in coaxial relationship with said magnetic rotor, and a cylindrical motor stator disposed on and about said exterior surface for magnetic cooperation with said rotor as a second motor part.

2. A light-weight electric motor driven fluid pump assembly as set forth in claim **1** wherein said two parts of said housing are joined in assembled relationship at mating surfaces by a continuous plastic weld thus dispensing with the need for a separate seal between said parts.

3. A light-weight electric motor driven fluid pump assembly as set forth in claim **2** wherein one of said housing parts has a small continuous raised bead on its mating surface, and wherein the other of said housing parts has a small continuous groove which complements said bead on said mating surface of said other part for effective fluid tight welding.

4. A light-weight electric motor driven fluid pump assembly as set forth in claim **2** wherein a sonic weld is provided between said housing parts.

5. A light-weight electronic motor driven fluid pump assembly as set forth in claim **2** wherein one housing part defines a scroll housing and a discharge opening communicating therewith, the impeller blades being located within said scroll housing and discharging radially to the discharge opening, and wherein the other housing part defines an inlet opening also in communication with said impeller blades.

6. A light-weight electric motor driven fluid pump assembly as set forth in claim **1** wherein one housing part defines an inlet opening, a discharge opening, and a scroll housing with the impeller blades in the scroll housing, and wherein the impeller carries an annular flange that forms a part of one side of the scroll housing adjacent the rotor chamber.

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